REMARKS

The Office Action dated January 4, 2007, has been received and carefully noted. The above amendments to the claims, and the following remarks, are submitted as a full and complete response thereto.

Claims 1-17 are currently pending in the application, of which claims 1, 9, and 17 are independent claims. Claims 1-17 have been amended to more particularly point out and distinctly claim the invention. No new matter has been added. Claims 1-17 are respectfully submitted for consideration.

Claims 2-5 and 10-13 were indicated as containing allowable subject matter, but were objected to as being dependent on rejected base claims. Applicant thanks the Examiner for this indication of allowability. Claims 2-5 and 10-13 have been amended, but it is respectfully submitted that the proposed amendments do not adversely affect the allowability of the claims. It is respectfully submitted that the base claims upon which claims 2-5 and 10-13 also contain allowable subject matter (as explained below), and, thus, it is respectfully requested that the objection to claims 2-5 and 10-13 be withdrawn.

Claims 1, 6-9, and 14-17 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Application Publication No. 2004/0142698 of Pietraski ("Pietraski") in view of U.S. Patent Application Publication No. 2004/0022213 of Choi et al. ("Choi"). Applicant respectfully submits that Pietraski is not proper prior art as applied, and Applicant respectfully traverses this rejection.

Pietraski was published on July 22, 2004, which is after the filing date of the present application. Furthermore, Pietraski's filing date is October 31, 2003, which is after the priority date of the present application of September 23, 2003. Pietraski claims priority to U.S. Provisional Patent Application 60/423,620 ("the Provisional Application"), filed November 1, 2002, but the Provisional Application does not contain all the material relied upon in the rejection.

Pietraski can only be viewed as prior art (if at all), for the material provided in the Provisional Application (a copy of which is enclosed herewith). Thus, Applicant respectfully submits that the rejection is not fully proper, because at least some cited portions of Pietraski are not, as a matter of law, prior art to the present application.

For example, the Provisional Application does not include Figure 1 of Pietraski, upon which the rejection relied, nor does it include paragraphs [0030] to [0034], upon which the Office Action relied, nor Figure 3 to which those cited paragraphs refer. Accordingly, Applicant respectfully submits that Pietraski is not proper prior art as applied, and respectfully traverses the rejection on at least this basis.

For the Examiner's convenience, certain further discussion of the cited art and the Provisional Application is provided below.

The provisional application of Pietraski discloses none of the steps of the independent method claim (claim 1). For example, the Provisional Application does not disclose either that the CQI report would include the number of multi-codes or that the effective code rate (ECR) would be calculated on the basis of the CQI report.

Likewise, in Pietraski, the ECR (coding and modulation scheme) is calculated in the mobile terminal before transmitting the CQI report.

Furthermore, the Provisional Application does not disclose either the number of parallel multi-codes of the CQI report exceeding the number of multi-codes available for transmission, calculation of the new estimates for ECR *etc.* based on the ratio of the numbers of the multi-codes, or executing the link adaptation based on the new estimates.

With respect to Pietraski, the Examiner agreed that this deficiency exists and cited Choi to remedy such deficiencies of Pietraski.

Choi generally relates to assigning CQI report cycles to user terminals according to the number of user terminal and the CQI information. Paragraphs [0006] and [0109], which were cited by the Examiner, describe a typical adaptive modulation and coding scheme in which a base station changes modulation and coding according to channel conditions between the user terminal and a serving base station.

These cited passages do not give any indication of the number of parallel multi-codes of any CQI report exceeding the number of multi-codes available for transmission. Likewise, none of the other paragraphs of Choi disclose any reaction to the case where the number of multi-codes of a CQI report exceeds the number of multi-codes currently available for the transmission.

Accordingly, Choi describes neither calculation of the new estimates for ECR *etc.* based on the ratio of the numbers of the multi-codes nor execution of the link adaptation based on the new estimates.

Since neither of the cited documents disclose the possibility of the number of multi-codes of a CQI report exceeding the number of multi-codes currently available for the transmission or actions taken in such case, the cited documents (whether viewed individually or in combination) do not provide a *prima facie* basis for asserting obviousness of the claimed invention.

Further, there is no proper motivation to combine the cited references. For this additional reason, a *prima facie* case of obviousness has not been established.

This lack of combinatorial teaching, motivation, or suggestion can be observed in the Office Action. At page 3 of the Office Action, it is acknowledged that "Pietraski does not teach a number of multi-codes of the CQI report exceeds a number of multi-codes available for transmission" and that Pietraski does not teach "calculating new estimates for the effective code rate, based on the received CQI report."

Furthermore, in the claims as presently pending, the number of parallel multi-codes of the CQI report exceeds the number of multi-codes available for transmission in the pending independent claims.

The next sentences of the Office Action then relate to Choi's describing a typical method for calculating the ECR on the basis of a CQI report, *i.e.* providing no indication of taking any action when the number of multi-codes of the CQI report exceeds the number of multi-codes currently available for the transmission.

Accordingly, the Office Action's citation of Choi fails to provide what is clearly absent from Pietraski and fails to provide a basis to go from what Pietraski teaches to what is claimed.

Additionally, the Office Action's proposed motivation "in order to improve overall utilization efficiency of a network by adaptively determining modulating and coding level according to a channel condition between a user equipment and a serving network," is not supported by citation of evidence, nor is it connected with the proposed modifications of, for example, calculating new estimates for the effective code rate under the conditions recited in the claims. Thus, for these additional reasons, withdrawal of the rejection of claims 1, 6-9, and 14-17 is respectfully requested.

For the reasons explained above, it is respectfully submitted that each of claims 1-17 recites subject matter that is neither disclosed nor suggested in the prior art. It is, therefore, respectfully requested that all of claims 1-17 be allowed, and that this application be passed to issue.

If, for any reason, the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, Applicant's undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, Applicant respectfully petitions for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,

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Fax: 703-720-7802

PCF:kzw

Enclosures: Copy of U.S. Provisional Patent Application No. 60/423,620

11-05-02 ~~Approv.~~ *Approv.*

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Please type a plus sign (+) inside this box ——▶ ☐+

PROVISIONAL APPLICATION FOR PATENT COVER SHEET
This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

INVENTOR(S)		
Given Name (first and middle [if any])	**Family Name or Surname**	**Residence (City and either State or Foreign Country)**
Philip J.	Pietraski	199 N. Oak Street Massapequa, NY 11758

☐ *Additional inventors are being named on the ___ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

CHANNEL QUALITY PREDICTION FOR SLOTTED COMMUNICATION SYSTEMS EMPLOYING ADAPTIVE MODULATION AND CODING

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

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ENCLOSED APPLICATION PARTS (check all that apply)

☒ Specification *Number of Pages*	8	☐ CD(s), Number
☒ Drawing(s) *Number of Sheets*	1	☒ Other (specify) Fee Transmittal
☐ Application Data Sheet. See 37 CFR 1.76		

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

☐ Applicant claims small entity status. See 37 CFR 1.27.		
☐ A check or money order is enclosed to cover the filing fees		FILING FEE AMOUNT ($)
☒ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number:	09-0435	160.00
☐ Payment by credit card. Form PTO-2038 is attached.		

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted,

SIGNATURE _____

TYPED or PRINTED NAME Rama B. Nath

TELEPHONE 215-568-6400

Date 11 / 01 / 02

REGISTRATION NO. *(if appropriate)* 27,072

Docket Number: 2-433US

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

Practitioner's Docket No. 2-433US   *PATENT*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: PIETRASKI, Philip J.

Application No.:   Not Yet Known   Group No.: Not Yet Known

Filed: Not Yet Known   Examiner: Not Yet Known

For: CHANNEL QUALITY PREDICTION FOR SLOTTED COMMUNICATION SYSTEMS
        EMPLOYING ADAPTIVE MODULATION AND CODING

Box Provisional Applications
Assistant Commissioner for Patents
Arlington, VA 22202

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Provisional Application for Patent and Filing Fee

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        Sandra L. Tompkins

        Sandra L. Tompkins
Signature of person mailing paper or fee

Date: November 1, 2002

InterDigital Communications Corporation
781 Third Avenue
King of Prussia, PA 19406
(610) 878-5633

(Express Mail Certificate--page 1 of 1)

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FEE TRANSMITTAL
for FY 2002

Patent fees are subject to annual revision.

Complete If Known	
Application Number	Not Yet Known
Filing Date	Not Yet Known
First Named Inventor	Philip J. Pietraski
Examiner Name	Not Yet Known
Group Art Unit	Not Yet Known

TOTAL AMOUNT OF PAYMENT	($) 160.00	Attorney Docket No.	2-433US

METHOD OF PAYMENT

1. [X] The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to:

Deposit Account Number: **09-0435**

Deposit Account Name: **InterDigital Comm. Corp.**

[X] Charge any Deficiencies or Credit any Overpayment in the Total Fees Associated With This Communication

[ ] Applicant claims small entity status. See 37 CFR 1.27

2. [ ] Payment Enclosed:
[ ] Check [ ] Credit card [ ] Money Order [ ] Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity		Small Entity		Fee Description	Fee Paid
Fee Code	Fee ($)	Fee Code	Fee ($)		
101	740	201	370	Utility filing fee	
106	330	206	165	Design filing fee	
107	510	207	255	Plant filing fee	
108	740	208	370	Reissue filing fee	
114	160	214	80	Provisional filing fee	160.00

SUBTOTAL (1) ($) 160.00

2. EXTRA CLAIM FEES

	Extra Claims		Fee from below	Fee Paid
Total Claims		- ** =	X	= 0
Independent Claims		- ** =	X	=
Multiple Dependent				= 0

Large Entity		Small Entity		Fee Description
Fee Code	Fee ($)	Fee Code	Fee ($)	
103	18	203	9	Claims in excess of 20
102	84	202	42	Independent claims in excess of 3
104	280	204	140	Multiple dependent claim, if not paid
109	84	209	42	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity		Small Entity		Fee Description	Fee Paid
Fee Code	Fee ($)	Fee Code	Fee ($)		
105	130	205	65	Surcharge - late filing fee or oath	0
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for *ex parte* reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	400	216	200	Extension for reply within second month	
117	920	217	460	Extension for reply within third month	
118	1,440	218	720	Extension for reply within fourth month	
128	1,960	228	980	Extension for reply within fifth month	
119	320	219	160	Notice of Appeal	
120	320	220	160	Filing a brief in support of an appeal	
121	280	221	140	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,280	241	640	Petition to revive - unintentional	
142	1,280	242	640	Utility issue fee (or reissue)	
143	460	243	230	Design issue fee	
144	620	244	310	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Processing fee under 37 CFR 1.17(q)	
126	180	126	180	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	740	246	370	Filing a submission after final rejection (37 CFR § 1.129(a))	
149	740	249	370	For each additional invention to be examined (37 CFR § 1.129(b))	
179	740	279	370	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 0

SUBMITTED BY

	Complete (if applicable)	
Name (Print/Type)	Rama B. Nath	Registration No. (Attorney/Agent) 27,072	Telephone 215-568-6400
Signature		Date November 1, 2002

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CHANNEL QUALITY PREDICTION FOR SLOTTED COMMUNICATION

SYSTEMS EMPLOYING ADAPTIVE MODULATION AND CODING

FIELD OF THE INVENTION

5   This invention relates generally to channel quality indicator (CQI) schemes in wireless communications, and more particularly to an improved CQI scheme for time-division duplex (TDD) and frequency-division duplex (FDD) transmissions.

BACKGROUND OF THE INVENTION

10   This application uses one or more of the following abbreviations:

ACK	Acknowledgement
ASC	Access Service Class
15 BCCH	Broadcast Control Channel
BCH	Broadcast Channel
CCTrCH	Coded Composite Transport Channel
CDMA	Code Division Multiple Access
CQI	Channel Quality Information
20 CRC	Cyclic Redundancy Check
DCA	Dynamic Channel Allocation
DL	Downlink

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	DPCH	Dedicated Physical Channel
	DTX	Discontinuous Transmission
	FACH	Forward Access Channel
	FDD	Frequency Division Duplex
5	HS-DSCH	High Speed Downlink Shared Channel
	HS-PDSCH	High Speed Physical Downlink Shared Channel
	HS-SCCH	Shared Control Channel for HS-DSCH
	HS-SICH	Shared Information Channel for HS-DSCH
	ISCP	Interference Signal Code Power
10	MAC	Medium Access Control
	NACK	Negative Acknowledgement
	NRT	Non-Real Time
	P-CCPCH	Primary Common Control Physical Channel
	PC	Power Control
15	PDSCH	Physical Downlink Shared Channel
	PRACH	Physical Random Access Channel
	PUSCH	Physical Uplink Shared Channel
	RACH	Random Access Channel
	RL	Radio Link
20	RRC	Radio Resource Control
	RSCP	Received Signal Code Power
	RT	Real Time

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	RU	Resource Unit
	SBGP	Special Burst Generation Gap
	SBP	Special Burst Period
	SBSP	Special Burst Scheduling Period
5	S-CCPCH	Secondary Common Control Physical Channel
	SCH	Synchronisation Channel
	SCTD	Space Code Transmit Diversity
	SFN	System Frame Number
	SIR	Signal–to-Interference Ratio
10	SSCH	Secondary Synchronisation Channel
	STD	Selective Transmit Diversity
	STPER	Single-transmission packet error rate
	TA	Timing Advance
	TDD	Time Division Duplex
15	TF	Transport Format
	TFC	Transport Format Combination
	TFCI	Transport Format Combination Indicator
	TFCS	Transport Format Combination Set
	TFRI	Transport Format Resource Indicator
20	TPC	Transmit Power Control
	TSTD	Time Switched Transmit Diversity
	TTI	Transmission Time Interval

3

TxAA	Transmit Adaptive Antennas
UE	User Equipment
UL	Uplink
UMTS	Universal Mobile Telecommunications System
UTRAN	UMTS Radio Access Network
VBR	Variable Bit Rate

5 UTRAN

Quality indicator schemes for wireless communications have been addressed from different angles in prior art. For instance, the quality indicator sent by the UE on the HS-SICH is a recommended Transport Format Resource Combination, 10 TFRC. The recommended TFRC is usually based on the HS-PDSCH resources most recently received by the UE and refers to the possible transport block sizes and modulation schemes available for these resources. Hence the channel quality indicator (CQI) consists only of the Transport Block Size and Modulation Format fields of the TFRI. The UE adopts the same mapping table for these 15 fields as is used by the NodeB.

The reporting procedure for the above CQI scheme is generally as follows:

1. The UE receives a message on an HS-SCCH telling it which resources have been allocated to it for the next associated HS-DSCH transmission.

20 2. The UE reads the HS-DSCH transmission, and makes the necessary measurements to derive a CQI that it estimates would give it the highest

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throughput for the allocated resources whilst still meeting a specified threshold BLER of 10%.

3. The UE reports the most recently derived CQI to the NodeB in the next available HS-SICH.

5 The current specification states for CQI reporting that "The UE reports the most recently derived CQI to the NodeB in the next available HS-SICH". This statement is ambiguous in that it can be interpreted that there is no time limit on how long the UE may take to derive the CQI, but once derived, it must be reported in the next available HS-SICH. It is however desirable that the CQI
10 derived from a given HS-DSCH transmission be reported in the next available HS-SICH following that transmission. This is to minimise the delay in getting the CQI information to the NodeB. Hence it is proposed to clarify this in the CQI description. In addition, the possibility exists that a CQI may be discarded by the UE before being reported to the NodeB. This situation can arise at the start of a
15 sequence of transmissions to the UE, as the first derived CQI will be superseded before the first HS-SICH becomes available. An example of this is shown in Figure 1 below. The association between CQI and HS-SICH could thus be unclear.

In some situations, the channel quality estimate used to inform the transmitter
20 of the coding and modulation scheme to use in the next transmission is based on the current quality measurement of the most recent data burst.

5

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It is desirable to clarify the above situations and provide a method of channel quality prediction without the disadvantages of known art.

SUIMMARY OF THE INVENTION

The present invention provides a method of improved channel quality

5   prediction for communications systems employing adaptive modulation and coding.

BRIEF DESCRIPTION OF THE DRAWING

Figure 1 illustrates a prior art example of a CQI report being discarded without being transmitted.

10

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

The present invention provides an improved method of channel quality prediction without the disadvantages of prior art.

In the present invention, in a time slotted communication system

15   employing Adaptive Modulation and Coding, the receiver reports back to the transmitter the coding and modulation scheme to be used in the next transmission. Since there is typically a delay sufficient to allow channel conditions to change before the next transmission, it is desirable for the receiver to report the coding and modulation to be used based upon the channel condition

20   predicted at the time of the transmission. (In priciple, either NodeB or UE may

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perform prediction, however, UE has more information on which to make such predictions. UE is therfore the prefered entity to perform prediction) Additionally, in a slotted system where the transmission burst may span several time slots, interference levels in these times slots can vary greatly. Also, the present

5   invention recognizes that channel fading conditions may change substantially from slot to slot. By including signal power and noise power prediction for each slot, the prediction of data burst quality can be improved. The coding and modulation reported to the transmitter can therfore be made more accurate, compared to the prior art situations.

10   It is to be noted that the present invention is applicable TDD, FDD, and other modes of transmission without exception.

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ABSTRACT

A method of channel quality prediction for slotted communication systems employing adaptive modulation and coding. In the inventive method, the receiver

5 reports back to the transmitter the coding and modulation scheme to be used in the next transmission. The coding and modulation reported to the transmitter is made more accurate by the invention.

HS-SCCH
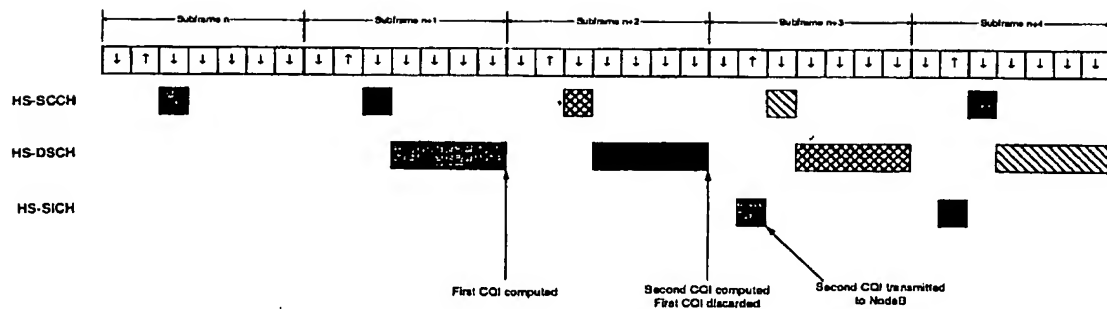
HS-DSCH

HS-SICH

First CQI computed

Second CQI computed
First CQI discarded

Second CQI transmitted
to NodeB

Figure 1